BROOKHAVEN NATIONAL LABORATORY

2010 RHIC Operations Review

Operations of PHENIX, STAR and RCF

Operations Overview

- BNL has the two large experiment operations/research groups plus the RHIC computing facility based in the Physics Department
- B&R Information

FY 10 Appropriations $M

B&R		Total New BA	Physics Department Allocation
KB-02-02-01-2	Ops and R&D	31.0	23.7
KB-02-02-01-2	Capital	4.5	4.5
Total		35.5	28.2

- 70.8 FTEs PHENIX+STAR+RCF
- ~1100 RHIC Facility Users
- Operations support:
  - All activities associated with PHENIX and STAR data taking during RHIC run typically 25-30 weeks /year. 24/7
  - Shutdown M&O tasks
  - Year round operation of RCF for data production and analysis
  - Extensive upgrades installation and commissioning in recent year
    - STAR: TOF, FMS, DAQ1000
    - PHENIX: HBD, Muon Trigger, VTX, DAQTRIG2010
  - Detector R&D program

BROOKHAVEN NATIONAL LABORATORY

FY09 Operations Budget Summary

Description	FY 09 Summary Experimental Operations Expenditures by Group (without R&D)				
	GENERAL	PHENIX	STAR	RCF	Grand Total
SALARY	4,529	3,464,231	3,305,789	2,319,957	9,094,506
PUR-LABOR	1,200	75,081	104,441		180,722
CEN-RECHRG	172	301,588	43,316	31,832	376,908
MSTC-LV	15,153	656,907	616,588	320,435	1,609,083
COM/MISC	888	37,036	47,470	23,328	108,722
PUR-HV	0	18,823	449,468	296,302	764,593
EQUIPMENT <50K	0	9,998	21,036	23,135	54,169
CEN-ALLOCS	167	127,484	121,653	85,374	334,678
OTH-ALLOCS	0	52	256	28	336
OTH-EXEMPT	1,571	217,547	258,248	158,818	636,184
DEPT-CHRGS	560	742,249	645,059	419,117	1,806,985
LABWIDE-OH	10,301	2,154,682	1,982,669	1,331,903	5,479,555
FUNDING	0	0	0	0	0
RECOVERY	0		-54		-54
FY Totals	**34,541**	**7,805,678**	**7,595,939**	**5,010,229**	**20,446,387**

Operations Labor

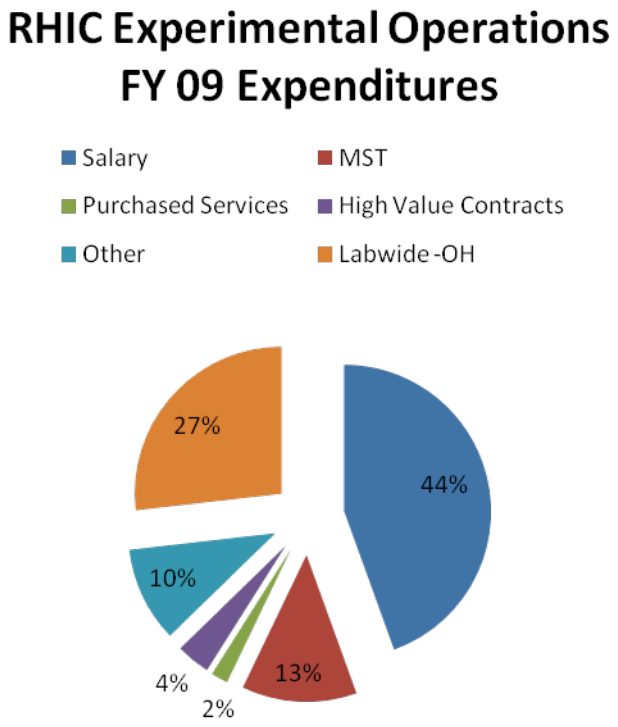
Sum of FTE			Fiscal Year	
FWP Number	Division	Code	FY 2010	Grand Total
PO004	**PHENIX**	Permanent PhD	9.3	9.3
		Temporary PhD	2.5	2.5
		PHD Post Doc	0.1	0.1
		Professional	7.9	7.9
		Technician	5.8	5.8
		Administration	1.1	1.1
	PHENIX Total		**26.7**	**26.7**
	STAR	Permanent PhD	5.8	5.8
		Temporary PhD	0.1	0.1
		PHD Post Doc	0.4	0.4
		Professional	13.9	10.0
		Technician	5.9	8.9
		Administration	1.8	2.8
	STAR Total		**27.9**	**27.9**
	RCF	Permanent PhD	0.5	0.5
		Professional	14.2	14.2
		Technician	1.0	1.0
		Administration	0.5	0.5
	RCF Total		**16.2**	**16.2**
Grand Total			**70.8**	**70.8**

RHIC Experimental Operations

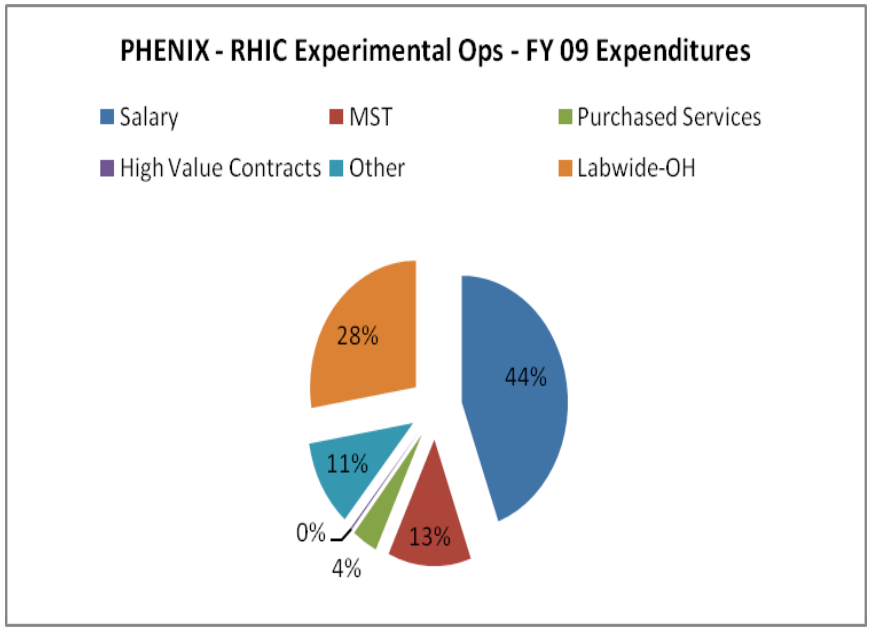
FY 09 and FY 10 Comparison

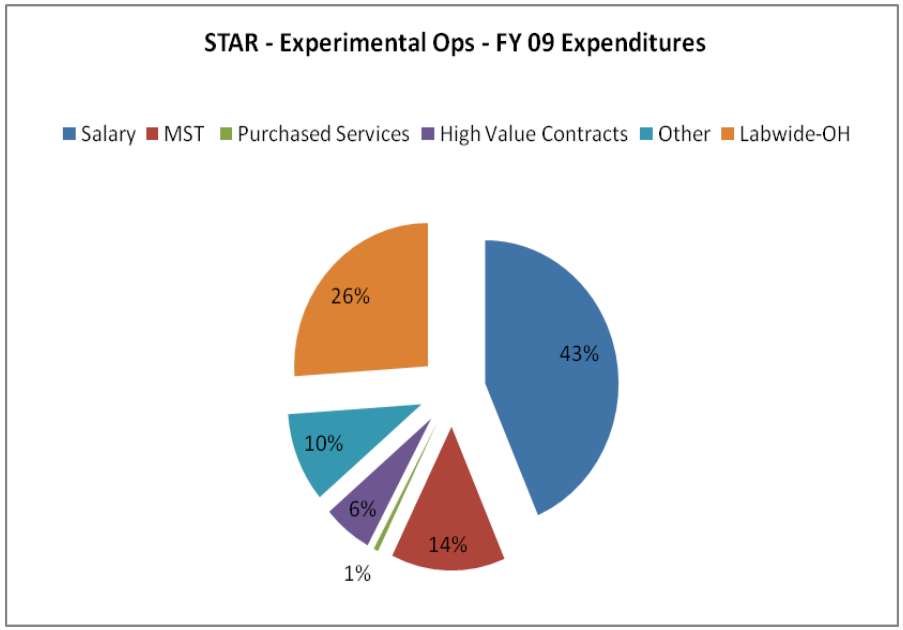
Plot Coding	Description	Summary Level Experimental Operations (without R&D) Actuals FY 09	FY 09 % of Total Expenses	FY 10 Cost Plan	YTD Expense May 2010	% FY 10 Cost Plan Expensed @ May 2010
Salary	SALARY	9,094,506	44%	9,528,397	6,077,823	64%
MST	PUR-LABOR	180,722	1%	262,153	185,017	71%
Purchased Services	CEN-RECHRG	376,908	2%	380,956	213,174	56%
MST	MSTC-LV	1,609,083	8%	1,899,859	1,297,232	68%
MST	COM/MISC	108,722	1%	152,635	87,852	58%
High Value Contracts	PUR-HV	764,593	4%	674,025	257,036	38%
MST	EQUIPMENT	54,169	0%	80,637	72,201	90%
Other	CEN-ALLOCS	334,678	2%	482,413	310,335	64%
Other	OTH-ALLOCS	336	0%	567	113	20%
Other	OTH-CHRGS	0	0%			
MST	OTH-EXEMPT	636,184	3%	922,076	487,031	53%
Other	DEPT-CHRGS	1,806,985	9%	1,983,900	1,292,738	65%
Labwide -OH	LABWIDE-OH	5,479,555	27%	6,011,715	3,850,594	64%
Other	RECOVERY	-54		-294	-294	100%
	FY Totals	**20,446,387**	**100%**	**22,379,039**	**14,130,852**	**63%**

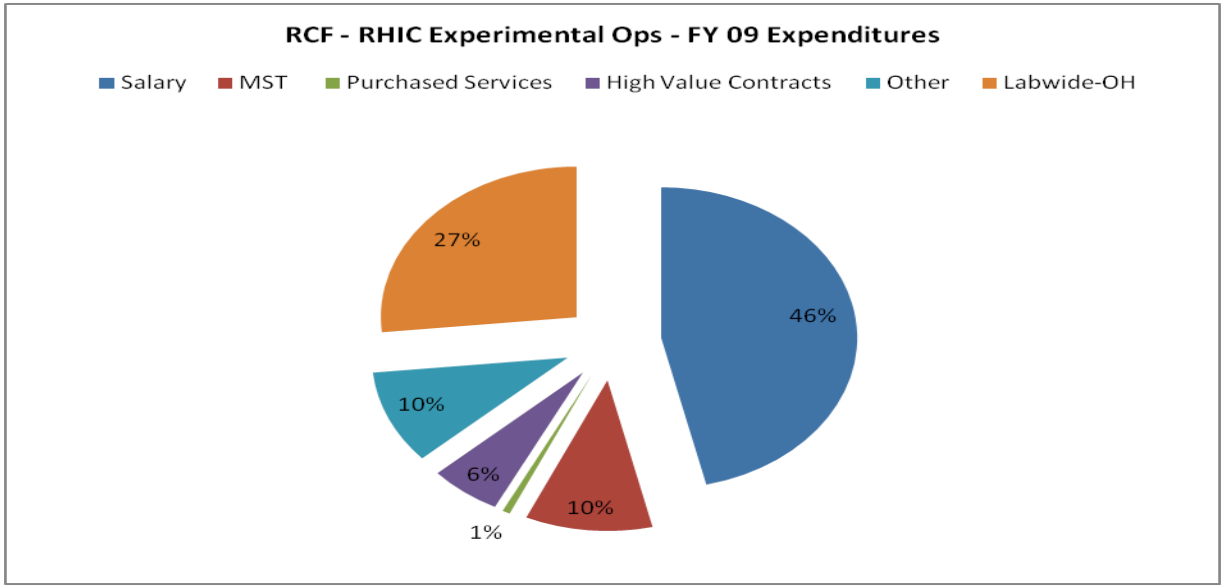
Summary Resource Allocation



Distribution of Expenditures







Experimental Operations Capital FY07-FY10

Experimental Operations Capital Fiscal Year Funding Allocations

			Fiscal Year				
DIVISION	Project	ProjDescr	FY 07	FY 08	FY 09	FY 10 May	Grand Total
NP OPS	48885	RHIC Detector Genl-Purch Cap	0	25,202	121,664	317,500	464,366
PHENIX	57160	PHENIX Facility Modification	244,861	200,000	0		444,861
	50024	Time of Flight-West	55,139				55,139
	50025	Hadron Blind Detector	0	0	5,336	0	5,336
	48861	General Purchase Equipment			140,000	0	140,000
	50096	PHENIX Facility Upgrade			460,000	400,000	860,000
RCF	48880	RCF - Purchased Capital	1,850,000	1,700,000	2,200,000	2,400,000	8,150,000
STAR	48875	STAR - Purchased Capital				362,500	362,500
	57170	STAR QA Infrstrctr Development	270,900	0	0		270,900
	50047	DAQ1000 Upgrade	429,100	685,800	0		1,114,900
	50092	Forward GEM Tracker for STAR		200,000	750,000	900,000	1,850,000
ZERO DEGREE	50044	Zero Degree Calorimeter	0	100,000	23,000	10,000	133,000
CA-D	50058	Experimental Water Upgrade	0	63,421	200,000	60,000	323,421
	50060	RHIC Air Compressor Upgrade	0	25,578	0	0	25,578
	50130	PHENIX HVAC Upgrades				75,000	75,000
	50131	PHENIX HSSD in Assembly Bldg				50,000	50,000
	50132	PHENIX RPC Wall Installation				50,000	50,000
	57501	STAR DAQ Room & IR AC Upgrade				65,000	65,000
Grand Total			**2,850,000**	**3,000,001**	**3,900,000**	**4,690,000**	**14,440,001**

FGT - the FY 09 funding includes funds that were re-programmed to ANL ($50k) and LBNL ($ 50k)
FY 10 includes transfer of $190k from TOF MIE prior year funding

BROOKHAVEN NATIONAL LABORATORY

Current Burden Rates - FY2010

Rate Description		Rate
Paid Absence		19.60%
Fringe Benefits		37.25%
Fringe Benefits - Post Docs		27.25%
G&A	Traditional	8.25%
	Common Support	24.00%
	LDRD Burden	5.00%
	IGPP Burden	2.50%
	Off Site	8.25%
	IPP Program Subcontracts	3.00%
ITD Burden		3.40%
Extraordinary Construction (Prior approval is required).	Traditional	5.50%
	Common Support	9.00%
Material Burden	Assessment is limited to the first 600K on a single procurement action. (Prior approval is required)	6.75%
Full Cost Recovery	Other Federal Agencies	3.00%
	Non-Federal Agencies*	3.00%
Fuel Tax (Applied on Resource Category 480, 481 & 482)		25.60%
Deferred Maintenance (applied on Resource Category 480, 481 & 482).		25.00%

RHIC Experimental Operations Monthly Expenditure Rate by Fiscal Year

Fiscal Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Grand Total
FY 09	1,366,237	1,618,832	1,551,092	1,467,913	1,816,672	1,819,971	1,784,985	1,748,088	1,789,771	1,795,630	1,726,822	1,960,392	20,446,405
FY 10	1,264,017	2,097,052	1,598,222	1,669,452	1,669,550	1,827,221	2,081,859	1,923,481					14,130,854

PHENIX/BNL Operations Responsibilities

- Operation of PHENIX Experimental facility and Collaboration Management
  - Membership in PHENIX Management group, Executive and Detector Councils
  - Coordination of physics run activities
  - All PHENIX facility ES&H, and Work Planning
  - Operating the local PHENIX office for visiting scientist and student support (~250/year)
  - Coordination of all experiment activities and publications
  - Data production and processing
  - Management, Coordination and participation in all shutdown work
    - Annual Detector maintenance
    - Installation and commissioning of Upgrade projects
- Responsibility for specific detector subsystems
  - **EMCal, ZDC, HBD, Magnets, DAQ, Online and Offline Computing, TEC, MPC, RXNP**
- Maintenance of PHENIX common systems
  - Safety systems, LV, HV, general computing and data bases, electronics control and timing, gas systems, cooling
- Participation on R&D for future upgrades projects

BROOKHAVEN NATIONAL LABORATORY

PHENIX Org Chart

Collaboration

Institutional Board

PHENIX Management

Spokesperson	Barbara Jacak	SBU
Operation Director	Ed O'Brien	BNL
Dpty Spokesperson	Yasuyuki Akiba	RIKEN
Dpty Spokesperson	Jamie Nagle	U Colorado
Dpty Ops Manager	John Haggerty	BNL
Dpty Ops Manager	Mike Leitch	LANL

Coordinators

Don Lynch Chief Engineer	Martin Purschke DAQ Coordinator	Carla Vale Computing Coordinator	Stefan Bathe Run Coordinator	Tony Frawley Analysis Coordinator	Jamie Nagle Trigger Coordinator	Brant Johnson PHENIX Admin

Executive Council

Barbara Jacak
Ed O'Brien
Yasuyuki Akiba
Jamie Nagle
Dave Morrison
Bill Zajc
Rich Seto
Matthias Grosse Perdekamp
John Lajoie
Olivier Drapier
Mike Leitch
Abhay Deshpande
Yuji Goto
Brant Johnson
Tony Frawley

Detector Council

Ed O'Brien
John Haggerty
Mike Leitch
Toru Sugatate
Victor Riabov
Vicky Greene
Achim Franz
Yasuo Miake
Hideki Hamagaki
Edward Kistenev
Justin Frantz
Martin Purschke
CY Chi
John Lajoie
Izhak Tserruya
Julia Velkovska
Sebastian White
Ken Read
Tony Frawley
Dave Winter
Carla Vale
Don Lynch
Jamie Nagle
Jeff Mitchell
Hugo Pereira da Costa

Physics WG Conveners

Gabor David
Shengli Huang
Roy Lacey
Jason Newby
Rachid Nouicer
Kensuke Okada
Victor Riabov
Kenta Shigaki
Anne Sickles
Ralf Siedel
Cesar Liuz da Silva
Julia Velkovska
Jiangyon Jia
Steve Pate

PHENIX: Distribution of Responsibilities Technical and Professional Staff

• DAQ, Electronics and Timing system Control	2.0 FTE's
• General computing, Online Offline Software, Data Production	3.0 FTE's
• LV, HV and Safety systems	1.5 FTE's
• Cooling and Gas System	1.5 FTE's
• Collaboration/Visitors support, Publications	1.3 FTE's
• BNL-based subsystems (EMCal, ZDC, HBD, TEC, MPC, RXNP, Magnets, VTX)	2.5 FTE's
• Management, Coordination, Work Planning	1.5 FTE's
• R&D	1.5 FTE's
Total	**14.8 FTE's**

+11.9 FTE's from Scientists working on Operations

PHENIX: Distribution of Responsibilities Scientific Staff

- DAQ, Electronics and Timing system Control — 1.25 FTE's
- General computing, Online Offline Software, Data Production — 2.25 FTE's
- BNL-based subsystems (EMCal, ZDC, HBD, TEC, MPC, RXNP, Magnets, VTX) — 4.9 FTE's
- Group/Collaboration/Visitors management, Publications — 1.5 FTE's
- R&D + Upgrades — 2.0 FTE's

Total — **11.9 FTE's**

BROOKHAVEN NATIONAL LABORATORY

PHENIX Upgrades

Upgrades Managers	**O'Brien/Leitch/Haggerty**
HBD	**Tserruya: Woody, Sickles, Sakaguchi**
MPC	**Chiu**
VTX	**Akiba: Nouicer, Pak**
DAQ Upgrades	**Haggerty/Nagle/Purschke: Pinkenberg**
FOCAL	**Seto/Lajoie: Kistenev, Vale**
MuTrigger	**Grosse Perdekamp/Saito**
Decadal Upgrade	**Nagle: Morrison, Haggerty, Vale, Kistenev, Pinkenberg, Chiu, White, Nouicer, Sickles, Franz, Purschke, O'Brien**

Significant effort by local group on R&D and Upgrades

STAR Org Chart: Researches and their roles

STAR Council
50 institutions,
13 countries
Chair; G. Westfall
BNL Rep: F. Videbaek

STAR Spokesperson
Xu
Deputy Spokespeople
Barranikova, Dunlop, Surrow

Talks Committee
Huang (Chair), Dong,
Margetis, Miooduszewski,
Peitzmann, Sumbera,
Van Buren

STAR Upgrades

Leader	Videbaek
IST	Surrow
HFT	Ritter/Videbaek, Beavis
FGT	Hassell
TOF	Eppley / Xu/ Ruan
DAQ1000	Ljubicic/Landgraf
FMS	Bland
pp2pp	Guryn
SSD	LeVine/Thomas
TOF+TPC PID:	Fisyak, Dong
MTD R&D	Xu, Ruan
HLT R&D	Ljubicic, Lauret, Tang
eA R&D:	Ullrich, Lamont, Debbe

STAR Physics Working Groups
Physics Analysis Coordinator: Mohanty

Bulk Correlations:	Raniwala, Sorensen
Heavy Flavor:	Dong, Calderon
Jet-like Correlations:	Putschke, Ray, Wang
Light Flavor Spectra:	Ruan, Takahashi
Spin:	Sowinski, Sichtermann
UPC:	Gorbunov, Guryn

BES Focus Group: Sorensen, Keane, Odyniec

STAR Group Leader: Dunlop

Administrative: Mogavero, Feliciano

STAR Operations

Detector Support Group

Leader:	Christie
DAQ:	Ljubicic, Landgraf
TPC:	Thomas, Lebedev
Trigger:	Crawford
HLT:	Tang, Ljubicic
Magnet:	C-AD, Longacre
Slow Crls:	Cherney
BEMC:	Tsai
EEMC:	Sowinski/Jacobs
FTPC/Laser:	Lebedev
ZDC:	Xu, Tang
BBC/FMS:	Bland, Ogawa
TOF :	Ruan, Xu, Eppley, Llope
PMD:	Viyogi/Chattopadhyay

Technical Support Group

D'Agostino	Head EE
Soja	MT
Scheblein	Designer
Kuzcewski	ET
Asselta	ET
Camerada	ET
Tkatchev	ET
Scheetz	EE, DAQ1000
Hammond	ET

Software & Computing

Lauret	Leader
Van Buren	Co-Leader
Didenko	Production
Webb	Simulation
Perevotchikov	Simulation
Fisyak	Reco Leader
Fine	Graphics/ Infrastructure
Arkhipkin	Online/Database
Betts, Ahrenstein	Real Time Support
Masui	PDSF/ Embedding
Witt/Thomas	TPC calibration
Hajdu	Grid Development

BNL Scientific Staff;
BNL Professional Staff;
Non-BNL Staff

STAR: Responsibilities for Technical and Professional Staff

- DAQ and DAQ1000 systems support — 1.5 FTE's
- Electronics system support and development — 4.6 FTE's
  - Including repair of electronics for all STAR subsystems during the run, and refurbishment during summer shutdowns
- FTPC and TPC Hardware support — 1.0 FTE's
- Data Production and Online Systems Support — 4.5 FTE's
- Software infrastructure and development — 3.0 FTE's

- Simulations infrastructure and development — 2.0 FTE's
- Management, Coordination, Work Planning — 2.0 FTE's

- Collaborator and visitor support — 1.0 FTE's
- Design for modifications/upgrades — 1.4 FTE's

Total **21 FTE's**

(Partial year hires + leave: -0.9 FTE this year)

+7 FTE's from Scientists on particular tasks

Hardware Operational Responsibilities

FTPC Hardware: Lebedev
TPC Hardware: Lebedev
Magnet: Longacre, Christie
DAQ (DAQ1000 + overall): Ljubicic, Landgraf
Zero Degree Calorimeters/Trigger: Xu, Tang, Beavis
Time of Flight, Muon Telescope Detector: Ruan, Xu
High Level Trigger: Tang, Ljubicic
Expect two post-docs: one for TOF, one for HLT and MTD (offers out)
Expect hire for trigger and DAQ

Key experimental support in the STAR Technical Support Group
Leader: Christie
Electronics support and repair for all STAR subsystems
Electronics Engineers: d'Agostino, Scheetz
Electronics Technician: Asselta, Camarada, Hammond, Kuzcewski, Tkatchev
Design for mods/new detectors: Scheblein
Facilities Manager and Mechanical Technician: Soja

Software Operational Responsibilities

Core team: repository for technical expertise critical for timely and correct physics results and to ensure data quality as it is recorded

Leader: Lauret
Co-leader: Van Buren
Data production coordinator and software librarian: Didenko
Distributed production support: Hajdu
Database administration and support: Arkhipkin
Reconstruction leader: Fisyak
Simulation leader: Perevotchikov
Simulation support specialist: Webb
Root development, visualization, and software architect: Fine
Real time systems support: Betts, Ahrenstein
Grid operation coordinator and distributed facility point of contact: Betts
Grid technology support: Hajdu

Detector subsystem software: DAQ: Landgraf FMS+Trigger: Ogawa

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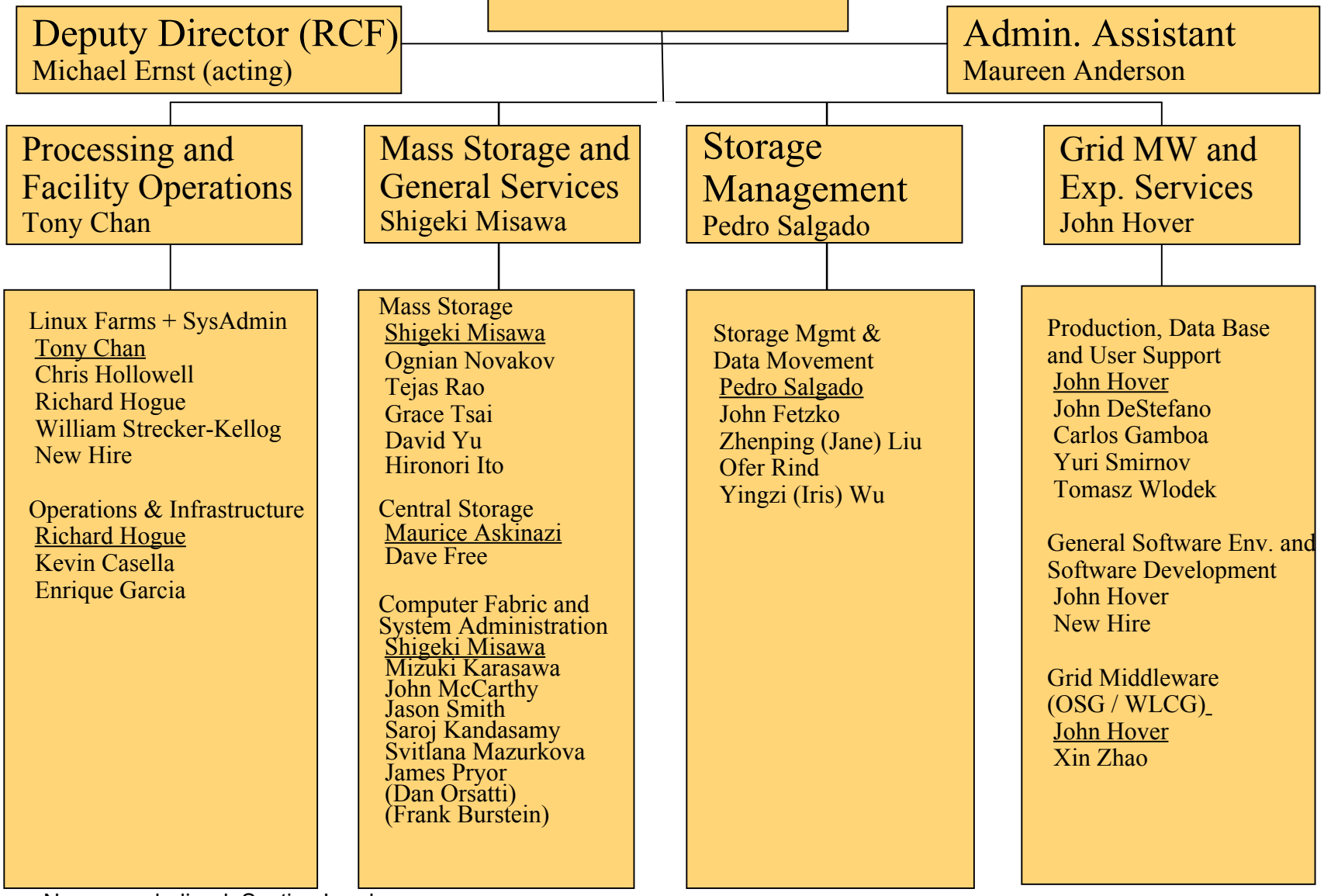
STAR Upgrades

Leader	Videbaek
IST	Surrow
HFT	Ritter / Videbaek, Beavis
FGT	Hassell
TOF	Eppley / Xu / Ruan
DAQ1000	Ljubicic / Landgraf
FMS	Bland
pp2pp	Guryn
SSD	LeVine / Thomas
TOF+TPC PID	Fisyak, Dong
High Level Trigger	Tang, Ljubicic
MTD	Xu, Ruan

An essential contribution in addition to basic research, rather unique because of the group's location at BNL, is development of new techniques and detector instrumentation to extend scientific reach. This contribution has been central to 4 of the 5 STAR upgrades developed thus far (FMS, TOF, DAQ1000, HFT) and to upgrades currently in the late planning stage (Roman Pots Phase 2, MTD)

RACF Org Chart



Names underlined: Section Leaders

BROOKHAVEN NATIONAL LABORATORY

RHIC Operations Program Personnel

RHIC Computing Facility

Area		Inst.	Class.	FY 2010 FTE Alloc.	Actual
RCF Administration		BNL/PO		0.50	0.50
Administrative Assistant		BNL/PO		0.50	0.50
			Effort (FTE):	**1.00** /	**1.00**
Fabric Infrastructure		BNL			
Facility Networking		BNL/ITD		0.50	0.50
Facility Networking		BNL/PO		0.25	0.25
Management of storage servers		BNL/PO		0.50	0.50
Ops of general Comp Infrastr.		BNL/PO		0.50	0.50
User account management		BNL/ITD		0.50	0.50
Facility Architecture dev		BNL/PO		0.75	0.75
Inst & cust of facility servers		BNL/PO		1.00	1.00
			Effort (FTE):	**4.00** /	**4.00**
Linux Systems					
Linux farm and comp room ops		BNL/PO		0.30	0.30
Leader Processing Services		BNL/PO		0.50	0.50
Dev, impl, ops Linux farm		BNL/PO		0.50	0.50
Compute farm operations		BNL/PO		0.50	0.00
Inst, cust of LRMS (Condor)		BNL/PO		1.00	0.00
			Effort (FTE):	**2.80** /	**1.30**
Storage Systems		BNL/PO			
Storage Management Sys ops		BNL/PO		0.70	0.70
Leader Storage Group		BNL/PO		1.00	1.00
Impl & ops Central Disk		BNL/PO		1.00	1.00
Operations of Central Disk		BNL/PO		1.00	1.00
Design & impl of mass storage		BNL/PO		1.00	1.00
Design & impl of mass storage		BNL/PO		1.00	0.30
Operations of mass storage H/W		BNL/PO		1.00	1.00
			Effort (FTE):	**6.70** /	**6.00**
Wide Area Services					
Documentation services		BNL/PO		0.50	0.50
Grid-based proc services dev		BNL/PO		0.30	0.30
Distrib Facility Monitoring dev		BNL/PO		0.50	0.50
Wide Area Transfer Services		BNL/PO		0.50	0.50
			Effort (FTE):	**1.80** /	**1.80**
RCF Operations					
Dev, plan, ops comp room infra		BNL/ITD		0.04	0.04
Ops Computer Room infra		BNL/ITD		0.02	0.02
Planning, impl Comp Room infra		BNL/PO		0.20	0.20
Inst, ops Computer Room infra		BNL/ITD		0.05	0.05
Facility services operations		BNL/PO		1.00	1.00
			Effort (FTE):	**1.31** /	**1.31**
RHIC Computing Facility			**Total Effort (FTE):**	**17.61**	**15.41**

BROOKHAVEN NATIONAL LABORATORY

RCF Equipment Spending Profile (k$)

Fiscal Year	2009	2010	2011	2012	2013	2014
Equipment Funds	2000	2400	2700	2800	3000	3000
Robot	0	200	0	200	50	50
Tape Drives	0	0	250	140	60	300
HPSS Cache	135	0	0	149	100	540
Network	250	258	350	200	0	500
Central Disk	200	0	200	180	240	270
CPU replacement	0	0	88	88	263	40
Central Server	100	160	100	75	50	100
PHENIX & STAR Computing Upgr.	1315	1782	1712	1843	2237	1200

- Available funds to increase PHENIX & STAR computing and storage capacity according to needs
- 2011: Obsolete CPU and Central Disk replacement, network upgrade
- HPSS Cache (disk arrays and data movers) were replaced in early FY10
  - With minor investment expected will carry us through to 2014 when the disk arrays and the Data Movers need to be replaced again

BROOKHAVEN NATIONAL LABORATORY

Mid Term Plan

Current funding plan for detector upgrades and RHIC computing

	FY 2010A	FY 2011P	FY 2012	FY 2013	FY 2014	FY 2015	FY2016	FY2017	
R&D funds									
PHENIX DAQ	0.45	0.15	0.10	0.10					**0.80**
PHENIX BarrelCal/Tracker	0.10	0.10	0.10	0.10					**0.40**
STAR GMT	0.10	0.05							**0.15**
STAR MTD	0.15								**0.15**
STAR HLT		0.30	0.20	0.10					**0.60**
STAR pp2pp		0.10							**0.10**
Generic Det. R&D	0.20	0.60	1.10	1.20	1.50	1.50	1.50	1.50	**9.10**
Total R&D	1.00	1.30	1.50	1.50	1.50	1.50	1.50	1.50	**11.30**
Experiment Capital									
PHENIX DAQ			0.10	0.20	0.30	0.20			**0.80**
PHENIX Forward Physics		0.50	0.80	0.30	0.20				**1.80**
STAR FGT	0.90								**0.90**
STAR MTD		0.20	0.50	0.40	0.30				**1.40**
STAR HLT				0.20					**0.20**
STAR pp2pp			0.20	0.20	0.20	0.20			**0.80**
Exp. Infrastr.	1.10	0.60	0.60	0.60	0.60	0.70	0.70	0.70	**5.30**
RCF	2.50	2.70	2.80	3.00	3.00	3.00	3.00	3.00	**23.00**
Total Capital	4.50	4.00	5.00	4.90	4.60	4.10	3.70	3.70	**34.20**
MIEs									
STAR HFT	2.40	2.90	4.55	4.40	0.95				**15.20**
PHENIX BarrelCal/Tracker				1.00	6.00	7.00	5.00	1.00	**20.00**
STAR Forward Physics					0.50	1.50	2.00		**4.00**
Total MIE	2.40	2.90	4.55	5.40	7.45	8.50	7.00	1.00	**39.20**

*** All new starts pending review and approval**

Budget Projection at Lab Proposed Level

*** * Brookhaven National Laboratory * ***

FY 2012 THRU FY 2016 AT PROPOSED LEVEL

Data will populate automatically from the FY2012 tab

SUMMARY:			FY09	FY10 Prsdt	FY10	FY11	FY11	FY12	FY13	FY14	FY15	FY16
**********		Notes	Actuals	Request	Approp	Guidance	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed
RHIC Exp Sup Ops	KB-02-02-01-2 OPE	Total	29524	31250	31035	32964	32964	35053	36394	37826	39314	40861
RHIC Exp Sup CE	KB-02-02-01-2 CE	Total	3600	4500	4500	4000	4000	5000	5175	5175	5175	5175
RHIC Program			FY09	FY10 Prsdt	FY10	FY11	FY11	FY12	FY13	FY14	FY15	FY16
RHIC Facility			Actuals	Request	Approp	Guidance	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed
Exp Support CA-D		*CA-D **	6832	7140	7091	7512	7512	7775	8047	8329	8620	8922
Exp Support PHYSICS		*Phy Ops**	21492	22910	22744	23952	23952	25778	26771	27843	28957	30115
Exp Support PHY Det R&D	*KB020201-2*	*Phy Ops*	1200	1200	1200	1500	1500	1500	1576	1654	1737	1824
Exp. Support CE CA-D		*CA-d*	200	0	300	300	300	300	311	321	333	344
Exp Support CE Phy		*Phy CE*	3400	4500	4200	3700	3700	4700	4865	5035	5211	5393
		Phy Ops/CE	26092	28610	28144	29152	29152	31978	33212	34532	35905	37332
EXP SUP PHYSICS			26092	28610	28144	29152	29152	31978	33212	34532	35904	37332
Salaries			12682	13719	13609	14130	14130	15445	16063	16706	17374	18069
M&S			5617	6105	6056	6288	6288	6873	7148	7434	7731	8041
Other			3193	3086	3079	3534	3534	3459	3561	3703	3851	4005
R&D			1200	1200	1200	1500	1500	1500	1576	1654	1737	1824
CE			3400	4500	4200	3700	3700	4700	4865	5035	5211	5393
Workforce (FTEs)												
PhD Permanent			13.9	15.5	15.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0
PhD Temporary			4.2	3.2	3.2	3.2	3.2	5.0	5.0	5.0	5.0	5.0
Tech/Admin Staff			50.6	52.1	52.1	52.1	52.1	54.4	54.4	54.4	54.4	54.4
Graduate Students			0	0	0	0	0	0	0	0	0	0

*Includes ALD and user Support

Budget Projections @ FY11 + 3.5% then COL

*** * Brookhaven National Laboratory * ***

FY 2012 @ FY 2011 +3.5% then COL

Data will populate automatically from the FY2012 tab

SUMMARY:			FY09	FY10 Prsdt	FY10	FY11	FY11	FY12	FY13	FY14	FY15	FY16
**********		Notes	Actuals	Request	Approp	Guidance	Proposed	+3.5%	+3.5%	+3.5%	+3.5%	+3.5%
RHIC Exp Sup Ops	KB-02-02-01-2 OPE	Total	29524	31250	31035	32964	32964	33818	35001	36226	37494	38807
RHIC Exp Sup CE	KB-02-02-01-2 CE	Total	3600	4500	4500	4000	4000	4140	4285	4435	4590	4751
RHIC Program			FY09	FY10 Prsdt	FY10	FY11	FY11	FY12	FY13	FY14	FY15	FY16
RHIC Facility			Actuals	Request	Approp	Guidance	Proposed	+3.5%	+3.5%	+3.5%	+3.5%	+3.5%
Exp Support CA-D		*CA-D **	6832	7140	7091	7512	7512	7775	8047	8329	8621	8923
Exp Support PHYSICS		*Phy Ops**	21492	22910	22744	23952	23952	24842	25712	26612	27542	28506
Exp Support PHY Det R&D	*KB020201-2*	*Phy Ops*	1200	1200	1200	1500	1500	1200	1242	1286	1331	1377
Exp. Support CE CA-D		*CA-d*	200	0	300	300	300	311	322	333	344	356
Exp Support CE Phy		*Phy CE*	3400	4500	4200	3700	3700	3829	3963	4102	4246	4395
									0	1	0	0
		Phy Ops/CE	26092	28610	28144	29152	29152	29872	30917	31999	33119	34279
EXP SUP PHYSICS			26092	28610	28144	29152	29152	29871	30918	31999	33119	34278
Salaries			12682	13719	13609	14130	14130	14748	15338	15951	16589	17253
M&S			5617	6105	6056	6288	6288	6563	6975	7124	7276	7429
Other			3193	3086	3079	3534	3534	3532	3400	3536	3677	3824
R&D			1200	1200	1200	1500	1500	1200	1242	1286	1331	1377
CE			3400	4500	4200	3700	3700	3829	3963	4102	4246	4395
Workforce (FTEs)												
PhD Permanent			13.9	15.5	15.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0
PhD Temporary			4.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Tech/Admin Staff			50.6	52.1	52.1	52.1	52.1	52.1	52.1	52.1	52.1	52.1
Graduate Students			0	0	0	0	0	0	0	0	0	0

*Includes ALD and user Support

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Proposed Addition of Four FTE's Starting in FY11 for Experiment Operations

- 1 FTE Project Management for Ongoing RHIC capital and R&D projects
- 1 FTE PHENIX to support new upgrades (VTX, FVTX) with a capital investment of $9.6M
- 1 FTE STAR to support new upgrades (TOF, DAQ1000, FGT, FMS) with a capital investment of $9.0M
- 0.5 FTE PHENIX to support future upgrades in mid-term and decadal plan
- 0.5 FTE STAR to support future upgrades in mid-term and decadal plan

The BNL plan for additional project management and oversight support of upgrade projects require additional resources and project management expertise. BNL Physics Dept has currently borrowed Project Management experts from C-AD but that is not a permanent solution. C-AD needs them back.

The new upgrades, recently completed, or finished by FY12 will have partial operations support from collaborating institutions but experience tells us that much of the operations responsibilities will fall to BNL.

Extensive plans for future PHENIX and STAR upgrades are a key component of RHIC's future. This will require significant R&D and upgrades detector work that go beyond the current activities of the operations groups.

Migration of PHENIX and STAR Detector Responsibilities to BNL

STAR

- Additions in the last few years: TPC, FTPC
- Chronic increases: TPC software support, DAQ/Trigger
- Future concerns: BEMC, EEMC
- Recent success: TOF

PHENIX

- Additions in the last few years: Data Production/Data Management
- Chronic Increases: DAQ, PC, PbGlass, various FEE's for multiple detectors
- Future concerns: VTX, FVTX
- Recent success: HBD, MuTrigger, RXNP

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Summary

The RHIC Operations group based in the BNL Physics Department consists of a staff of 71 FTE's with a FY10 budget of $28.2M (Ops+R&D+Exp Cap)

- Operate 2 large experiments (PHENIX and STAR)
  - **Physics running 25-30 weeks/yr**
  - **Maintenance, service and upgrades the remainder of the year**
- Operate the RHIC computing facility
  - **~ 2 Pbytes of raw data taken in FY10 RHIC run.**
  - **Real time computing, data archiving, data production, analysis, simulations**
- Collaboration Management and Visitors support
  - **~1100 RHIC user.**
  - **50% come to BNL each year, a larger fraction use RCF**
- Extensive detector upgrade program
  - **PHENIX & STAR have each added on average 1 new subsystem/yr for the last few years**
- Very active detector R&D program whose end result has been a series of successful detector upgrades
- Proposal to add 4 FTE's to better manage future upgrade projects, operate the newest upgrade detectors and carryout R&D for the future of PHENIX and STAR

Back Up

FY09-FY10 Exp Capital and R&D

		FY 2009	FY 2010A	Units AY$k
R&D funds				
	PHENIX DAQ	150,000		450,000
	PHENIX FOCAL	200,000		
	PHENIX MuTrigger	50,000		
	PHENIX BarrelCal/Tracker			100,000
	STAR Heavy Flavor Tracker	680,000		
	STAR Silicon Strip Det	100,000		
	STAR GEM Monitor for Tracking	20,000		100,000
	STAR Muon Telescope			150,000
	Generic Det. R&D			200,000
	Total R&D	1,200,000		1,000,000
Experiment Capital				
	PHENIX DAQ	250,000		
	STAR FGT	750,000		900,000
	†Exp. Infrastr.	500,000		800,000
	RCF	2,000,000		2,500,000
	Total Capital	3,500,000		4,500,000

All new starts pending review and approval

† Experiment infrastructure includes PHENIX and STAR beampipes, HVAC upgrades for 1006 &1008, rack and rack platforms for PHENIX, upgraded PHENIX water cooling system, etc.

RHIC Experimental Groups

Staffing Levels (FTE's) @ January 15, 2010

	PHENIX	STAR	RHIC Computing	SPIN	Total
RHIC Operations					
Physicist	11.9	6.3	0.5		18.7
Professional	7.9	13.9	14.2		36.0
Tech/Adm	6.9	7.7	1.5		16.1
Subtotal	**26.7**	**27.9**	**16.2**		**70.8**
Heavy Ion and SPIN Research					
Physicist	8.9	9.8		8.2	26.9
Professional	0.5			0.0	0.5
Tech/Adm	1.6	0.2		1.0	2.8
Subtotal	**11.0**	**10.0**		**9.2**	**30.2**

Corrected (6/10) Professional 3.9 FTE STAR IT (Professional) labeled Tech designation in the original Jan table. No change in Totals

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C-AD RHIC Experiment Infrastructure Capital Budget

June 1, 2010

Project	ES&F Project Name	Actual ≤ FY 2009	Actual FY 2010	Request FY 2011	Request FY 2012	Project Totals
48563	FY09 EPS General	$ 154,456				$ 154,456
50042	STAR Shielding Upgrade	$ 91,641				$ 91,641
50043	STAR Safety System Upgrade	$ 72,668				$ 72,668
50058	Experimental Water Upgrade	$ 333,421	$ 60,000			$ 393,421
50059	Experimental A/C Cooling Upgrade	$ 70,000		$ 75,000	$ 50,000	$ 195,000
50060	RHIC Air Compressor Upgrade	$ 51,578		$ 25,000	$ 25,000	$ 101,578
50130	PHENIX HVAC Upgrade	$ -	$ 75,000	$ 75,000		$ 150,000
50131	PHENIX HSSD in Assembly Bldg.	$ -	$ 50,000			$ 50,000
50132	PHENIC RPC Wall Installation	$ -	$ 50,000			$ 50,000
56532	PHENIX A/C	$ 151,119				$ 151,119
57340	STAR & PHENIX Chiller Installation	$ 164,098				$ 164,098
57480	Polarized Jet Target	$1,324,800				$ 1,324,800
57495	PHENIX (and jet target) Seismic Restraints	$ 25,631		$ 25,000		$ 50,631
57496	PHENIX Counting House A/C	$ 135,170				$ 135,170
57497	PHENIX IR Sector 7 & 8 Safety Platforms	$ 135,416				$ 135,416
57498	STAR Modified Chilled Water	$ 111,822				$ 111,822
57499	STAR Solenoid Power Supply Soft Start	$ 60,213				$ 60,213
57500	Emergency Generator Upgrade	$ 41,209				$ 41,209
57501	STAR DAQ Room & IR A/C Upgrade	$ -	$ 65,000	$ 50,000		$ 115,000
	PHENIX 13.8 KV switchgear upgrade			$ 50,000		$ 50,000
	STAR 13.8 KV cross-connect feeds				$ 125,000	$ 125,000
	STAR crane upgrade, variable speed drive				$ 200,000	$ 200,000
	Specialized Rigging Equipment				$ 100,000	$ 100,000
	Total for each FY		$ 300,000	$ 300,000	$ 500,000	$ 4,023,241

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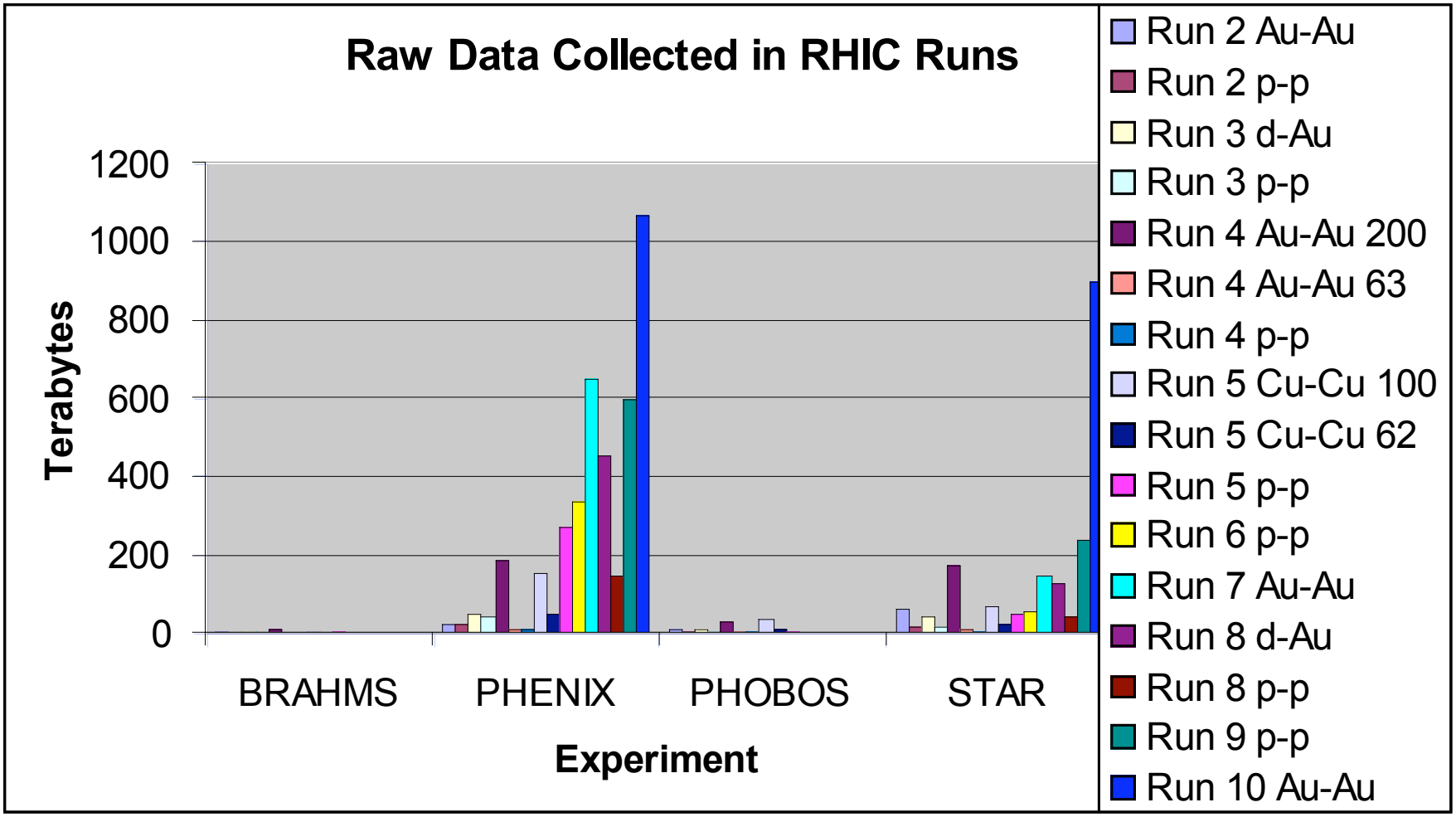
C-AD RHIC Experiment Infrastructure Capital Budget

June 1, 2010

Project	ES&F Project Name	≤ FY 2002	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	Project Totals
48563	FY09 EPS General	$ (245)	$ 158,159	$ 5,229	$ 18,249	$ (26,653)	$ (283)					$ 154,456
50042	STAR Shielding Upgrade					$ 125,000	$ (20,038)	$ 677	$ (13,998)			$ 91,641
50043	STAR Safety System Upgrade					$ 75,000	$ (2,183)	$ (150)				$ 72,668
50058	Experimental Water Upgrade						$ 70,000		$ 63,421	$ 200,000	$ 60,000	$ 393,421
50059	Experimental A/C Cooling Upgrade						$ 70,000					$ 70,000
50060	RHIC Air Compressor Upgrade						$ 26,000		$ 25,578			$ 51,578
50130	PHENIX HVAC Upgrade										$ 75,000	$ 75,000
50131	PHENIX HSSD in Assembly Bldg.										$ 50,000	$ 50,000
50132	PHENIC RPC Wall Installation										$ 50,000	$ 50,000
56532	PHENIX A/C			$ 150,000	$ 370	$ 1,653	$ (904)					$ 151,119
57340	STAR & PHENIX Chiller Installation	$ 70,256	$ 93,841									$ 164,098
57480	Polarized Jet Target		$ 936,000	$ 250,000	$ 140,000		$ (746)	$ (453)				$ 1,324,800
57495	PHENIX Seismic Restraints				$ 45,000	$ (21,845)	$ 2,487	$ (11)				$ 25,631
57496	PHENIX Counting House A/C				$ 100,000	$ 61,845	$ (26,667)	$ (8)				$ 135,170
57497	PHENIX IR Sector 7 & 8 Safety Platforms				$ 90,000	$ 45,000	$ 416					$ 135,416
57498	STAR Modified Chilled Water				$ 115,000		$ (3,178)					$ 111,822
57499	STAR Solenoid Power Supply Soft Start				$ 71,381		$ (11,150)	$ (18)				$ 60,213
57500	Emergency Generator Upgrade				$ 45,000		$ (3,754)	$ (38)				$ 41,209
57501	STAR DAQ Room & IR A/C Upgrade										$ 65,000	$ 65,000
	Total for each FY	$ 70,011	$ 1,188,000	$ 405,229	$ 625,000	$ 260,000	$ 100,000	$ 0	$ 75,000	$ 200,000	$ 300,000	$ 3,223,241

RAW Data collected in RHIC Runs



BROOKHAVEN NATIONAL LABORATORY

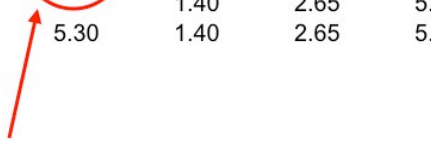
Mid Term Plan

Current DOE funding plan for detector upgrades and RHIC computing

June 09 update: FY 2006-2008 as spent.; 09Approp.; 2010Pres.

	FY 2006A	FY 2007A	FY 2008A	FY 2009A	FY 2010P	FY 2011	FY 2012	FY 2013	FY 2014	
R&D funds										
PHENIX HBD	0.10									**0.10**
PHENIX MIEs	0.30	0.45	0.16							**0.91**
PHENIX DAQ	0.10	0.05	0.26	0.40	0.60	0.20	0.25			**1.86**
STAR Tracking	0.50	0.32	0.70	0.80	0.40	0.20	0.25			**3.17**
Generic Det. R&D	0.00				0.20	0.80	1.00	1.50	1.50	**5.00**
Total R&D	1.00	0.82	1.12	1.20	1.20	1.20	1.50	1.50	1.50	**11.04**
Exp. Capital										
PHENIX HBD/TOFW	0.40	0.10								**0.50**
STAR FMS	0.20	0.20								**0.40**
STAR DAQ1000	0.90	0.35	0.65	0.00						**1.90**
STAR FGT			0.20	0.75	0.90	0.00				**1.85**
PHENIX FoCal*					0.30	0.80	0.70			**1.80**
Exp. Infrastr.	0.60	0.35	0.45	0.75	0.80	1.00	0.85	0.85	0.85	**6.50**
RCF	1.30	1.70	1.70	2.00	2.50	3.00	3.00	3.00	3.00	**21.20**
Total Capital	3.40	2.70	3.00	3.50	4.50	4.80	4.55	3.85	3.85	**34.15**
MIEs										
STAR TOF	2.40	2.40								**4.80**
PHENIX VTX		1.60	2.00	1.10						**4.70**
PHENIX FVTX			0.70	4.20	0.00					**4.90**
STAR HFT**					1.40	2.65	5.40	5.60	0.25	**15.30**
Total MIE	2.40	4.00	2.70	5.30	1.40	2.65	5.40	5.60	0.25	**23.85**

* Pending review and approval
** Pending final science approval



Full funding in FY 09 via ARRA funds

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Physics Dept R&D

PHENIX/STAR R&D and Cap FY06-10

Item	2006	2007	2008	2009	2010
STAR HFT	$400,000	$320,000	$600,000	$800,000	
STAR FGT	$100,000		$100,000		
STAR GMT					$100,000
STAR MTD					$150,000
PHENIX HBD	$140,000	$40,000			
PHENIX VTX	$290,000	$100,000			
PHENIX FVTX	$45,000	$270,000	$50,000		
PHENIX Forward Calorimetry	$45,000	$45,000	$60,000	$200,000	$100,000
PHENIX MuTrigger		$60,000	$50,000	$50,000	
PHENIX DAQ R&D	$50,000		$250,000	$50,000	$350,000
PHENIX BarrelCal/Tracker					$100,000
Generic R&D					$200,000
Total	$1,070,000	$835,000	$1,110,000	$1,100,000	$1,000,000

Item Physics Dept Capital	2006	2007	2008	2009	2010
STAR FGT			$200,000	$750,000	$900,000
STAR DAQ1000	$900,000	$350,000	$650,000		
STAR FMS	$200,000	$200,000			
STAR Beampipe					$362,000
PHENIX HBD	$400,000	$100,000			
PHENIX DAQTRIG2010				$100,000	$200,000
PHENIX Infrastructure for upgrades(racks,platforms,access,...)	$300,000	$300,000	$200,000	$160,000	$250,000
PHENIX new beampipe				$190,000	
PHENIX Muon Arm Shield					$150,000
Total	$1,800,000	$950,000	$1,050,000	$1,200,000	$1,862,000

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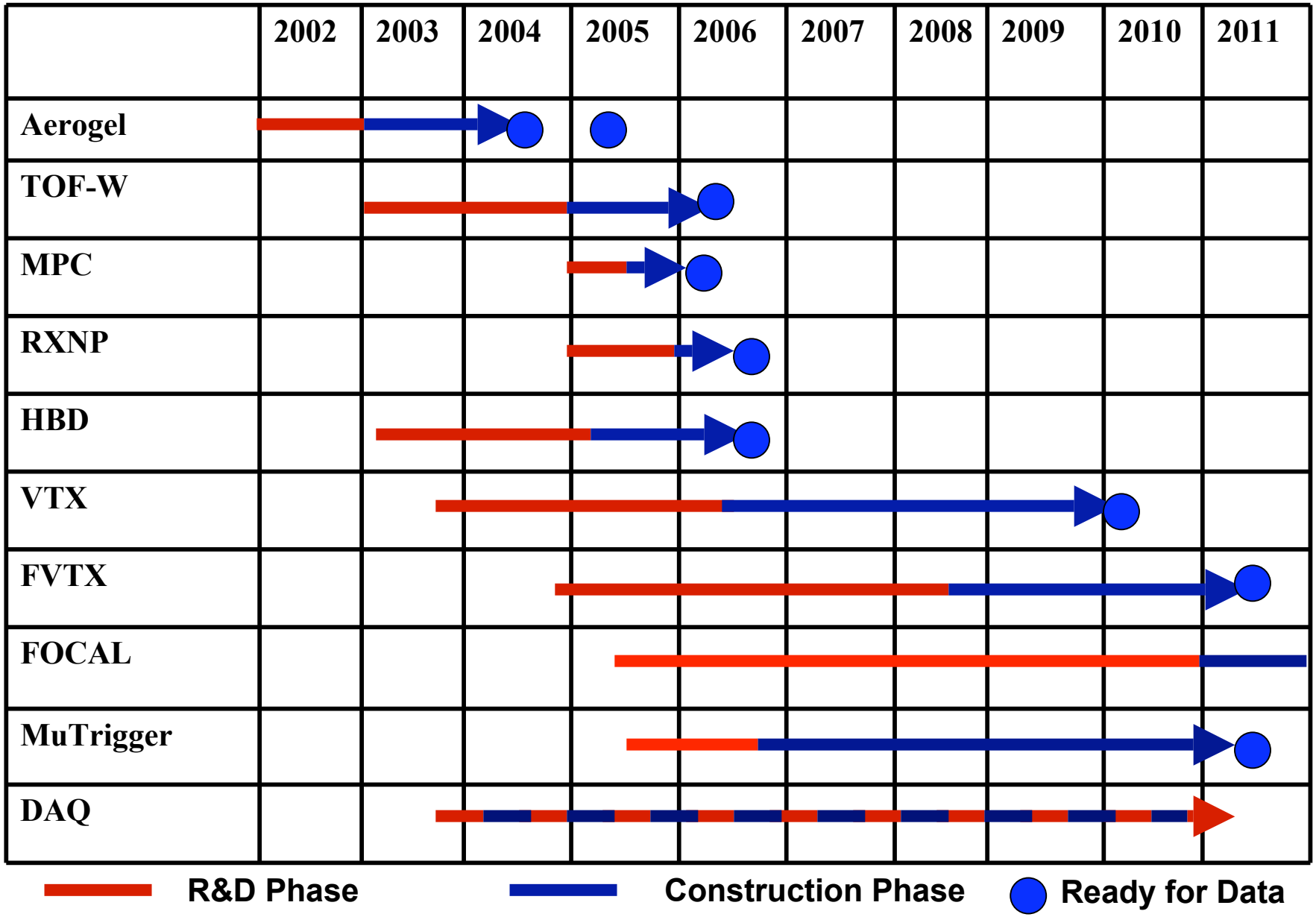
PHENIX Upgrade Schedule



December 2, 2009

Memorandum of Understanding among the Muhlenberg College, PHENIX Collaboration and the BNL Physics Department Regarding Institutional Responsibilities and Participation in the PHENIX Collaboration

1. Introduction

The purpose of this Memorandum of Understanding (MOU) is to establish the policy, mutual obligations and areas of responsibility that will define the framework of collaboration among the members of Muhlenberg College, the PHENIX Collaboration and the Physics Department at Brookhaven National Laboratory.

The primary function of the agreement signed by the BNL Physics Department, the PHENIX Collaboration, and each participating institution is to specify the various responsibilities for scientific research, operations, and upgrades for the PHENIX experiment. PHENIX upgrade responsibilities can include both R&D and construction of upgrade components for the experiment.

Details of tasks and work requiring transfer of funds between BNL and Muhlenberg College will be administered through Statements of Work (SOWs) to be generated by the Muhlenberg College with the concurrence of PHENIX Management. The SOWs will be a basis for any contracts between BNL and Muhlenberg College.

2. Tasks

The Muhlenberg group will undertake the following responsibilities as part of their participation in the PHENIX collaboration:

1) Research, development and fabrication of a variety of components associated with the PHENIX Muon Trigger RPC upgrade. This work includes but may not be limited to the development, fabrication and testing of MuTrg RPC components.

2) During the commissioning phase of the PHENIX MuTrg RPC, and as necessary during and after prolonged shutdowns or upgrades, the Muhlenberg group will maintain sufficient "expert" technical presence at BNL to bring the Muon Trg RPC system into full operation in a timely and efficient way. Practical details (timing of visits, etc.) will be worked out with the PHENIX Operations group.

3) Assuming tasks 1 and 2 have been successfully completed and after routine operation of the MuTrg RPC system has been established, further operation of this detector component will be the responsibility of PHENIX shift personnel who have been appropriately trained. The Muhlenberg College group is responsible for developing any specialized training and operations documentation required to hand over routine operation of the Muon Trg RPC system to PHENIX shift personnel.

4) After routine operation has been established, the Muhlenberg College group will not be required to maintain an "expert" technical presence at BNL at all times. However, the Muhlenberg group will be expected to provide a call-down list which insures that someone with appropriate expertise in the Muon Trg RPC system may be reached at all times, with a delay of less than 1-2 hours. The decision to consult institutional experts will be made by the PHENIX Run Coordinator or the PHENIX Period Coordinator (see report of the PHENIX Shift Policy Task Force by M. Sivertz et al and the report of PHENIX Run-3 Organization Task Force, A. Frawley et al.). Every reasonable attempt will be made to solve problems using on-site expertise before calling upon on-call experts.

5) In the event of a serious problem, which cannot be repaired with remote consultation, the Muhlenberg group will be responsible for sending someone to BNL who has the expertise to fix the problem. An "Emergency Expert" should be able, if necessary; to travel to BNL with 72 hours notice. The decision to send someone or not will be discussed with the PHENIX Director of Operations. It will be based on practical factors such as the severity of the problem, the uniqueness of the expertise that is required, and the availability of the component or system for repair upon arrival of the expert. In the event that the technical expertise is provided to the Muhlenberg group on a cost recovery basis, the cost is to be covered by the operating budget of the Muhlenberg group.

3. Data commitments

The Muhlenberg College group will be involved in data taking and data analysis within the standard physics working groups of the PHENIX collaboration. The Muhlenberg College group will abide by the PHENIX collaboration policies for publication and other dissemination of results adopted by the PHENIX collaboration Institutional Board. The data and the software shall be made accessible to all PHENIX collaborators in order to provide equal opportunity to contribute to the analysis.

PHENIX provides access to all collaborating institutions to the PHENIX database located at BNL. The PHENIX Collaboration provides (appropriately secured) local access to the computing/data storing facilities of PHENIX for all collaborating

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institutions. In addition, the collaboration shall allow the installation of a copy of the data and PHENIX software at Muhlenberg College.

In general, the PHENIX collaboration is expected to provide all information regarding PHENIX collaboration meetings including timely summaries or postings to the Web.

The Brookhaven National Laboratory shall provide the necessary local resources (offices, computers, software environment) for the effective participation of the Muhlenberg College group on PHENIX.

The Muhlenberg College group is responsible for the confidential handling of internal information related to the collaboration, and shall follow the standard PHENIX by-laws and publication policy in handling PHENIX data.

4. **General Provisions**

Any matter not dealt with by the provisions of the present MOU shall be subject to the relevant provisions of the PHENIX collaboration bylaws adopted by the PHENIX collaboration Institutional Board including shift and authorship requirements, service to the collaboration, rules governing submissions of abstracts on the behalf of PHENIX, presentations of PHENIX results and use of PHENIX data. See the appropriate documents located at: http://www.phenix.bnl.gov/WWW/publish/jacak/sp/index.htm

This Memorandum of Understanding will become effective upon the date of signature of all the parties. Modifications of this MOU shall be approved and signed by all the parties.

5. **Approvals**

The undersigned parties agree to make every effort to honor this Memorandum of Understanding in the interest of achieving optimal performance of the PHENIX Detector.

PHENIX Spokesperson — B. V. Jacak — date: 1/20/2010

PHENIX Director of Operations — E. J. O'Brien — date: 1/19/2010

BNL Physics Department Chair — T. Ludlam — date: 1/21/10

Muhlenberg College PHENIX Group Leader — B. Fadem — date: 12/9/09

Chair Muhlenberg College Physics Dept — J. Flood — date: 12/17/09